Building Green with Insulating Concrete Forms

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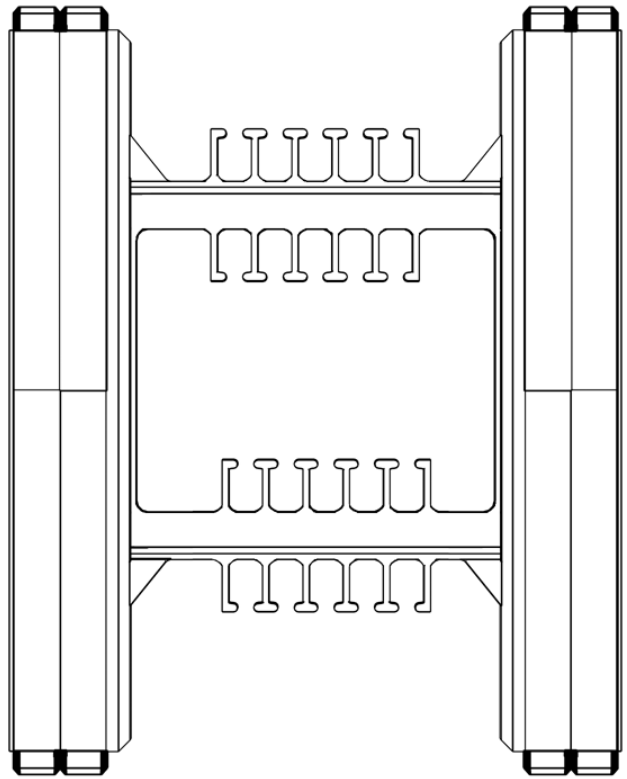
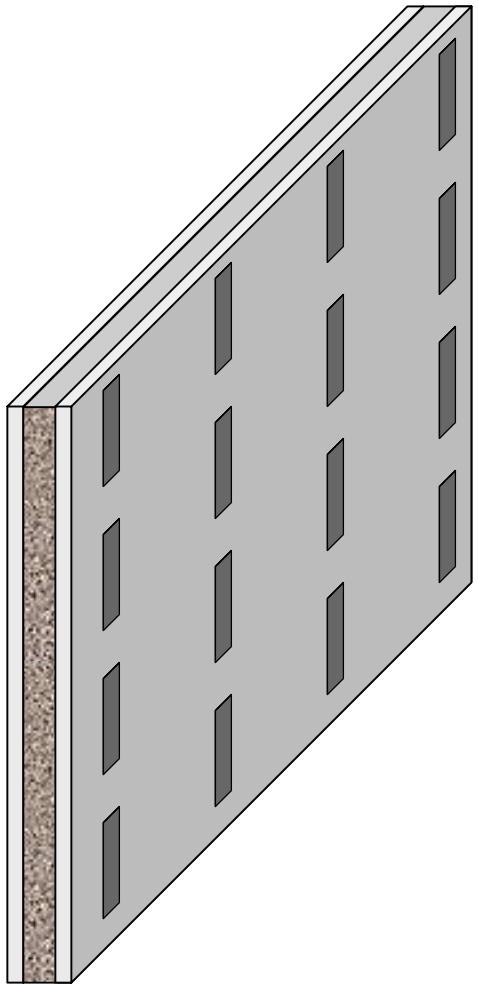
REWARD® WALL SYSTEMS

Wall Functions

- Structure
- Insulation
- Finish
  - Attachment
- Chase for utilities





Typical ICF Wall

100% insulation (R- 16 to 22)

100% monolithic structure

Integral furring

Fully insulated chase cavity

History

Invented in 1946 as Durisol

Wood waste and cement

in post-war Europe

Polystyrene foam

Introduced in 1970's

Growth Industry

1990's to present

Components

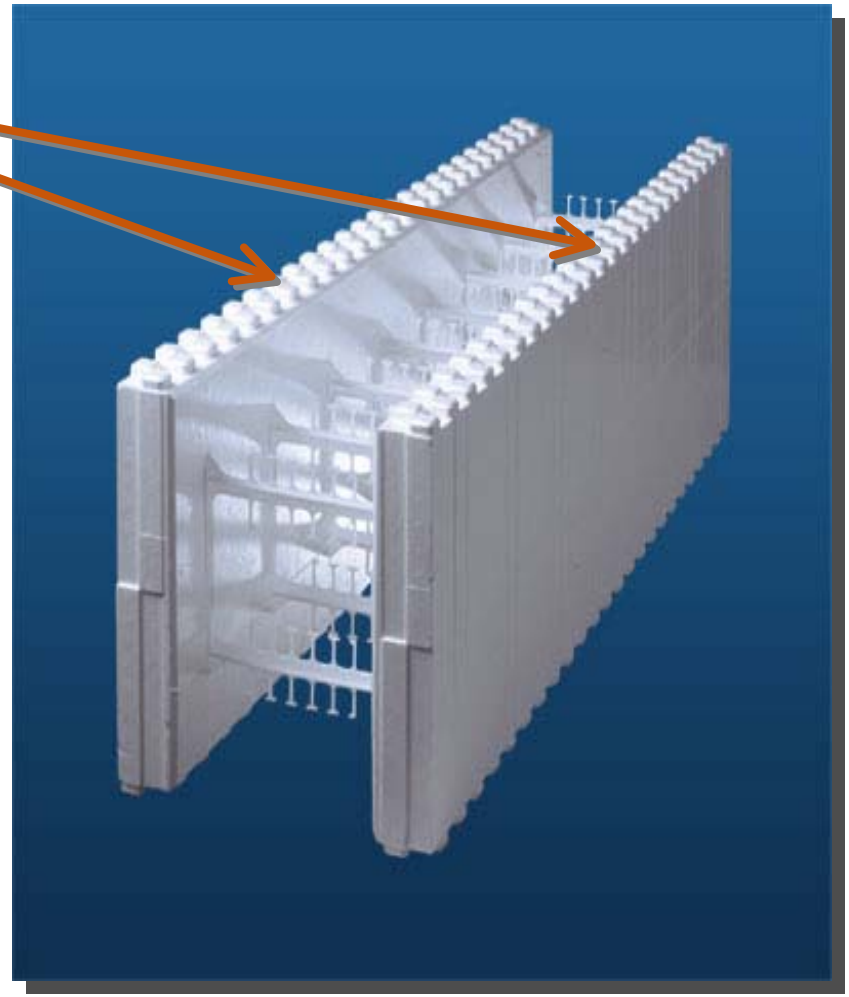
Face Shell

2 to 2.5″ thick

R- 18 to R-22

EPS or XPS

Withstands internal pressure of concrete during placement



Components

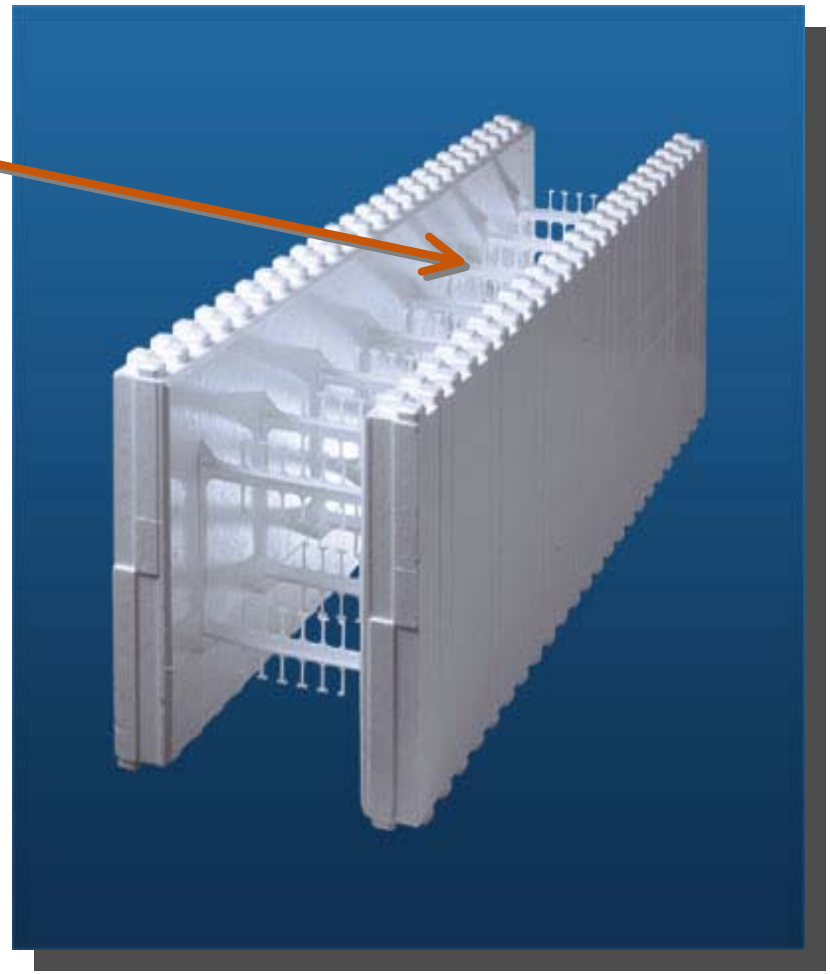
Form Tie

Plastic or metal

6″ to 12″ o.c.

Rebar saddles

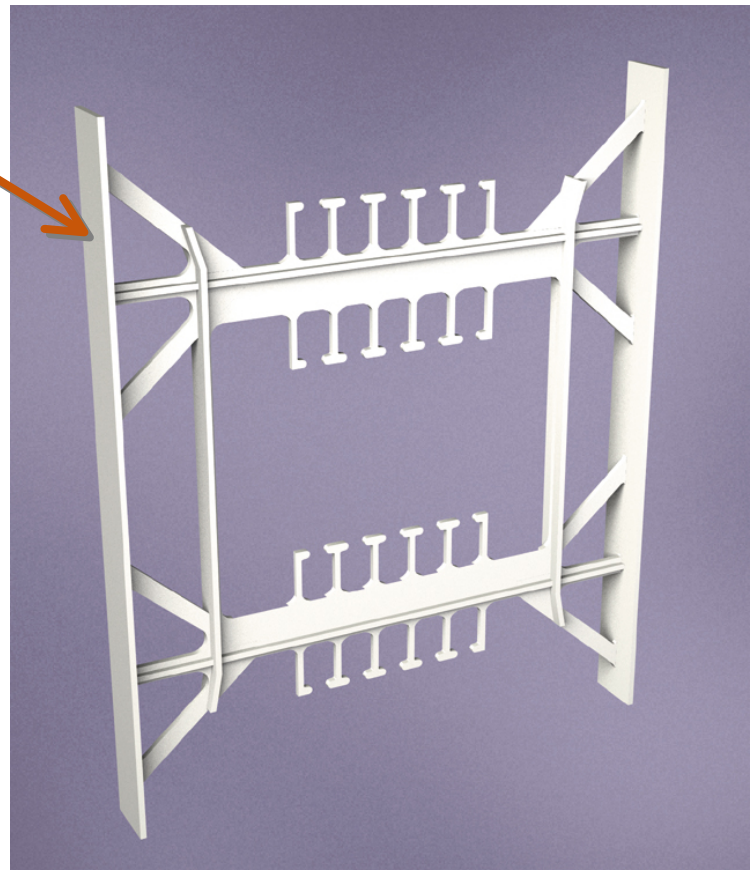
TEST of STRENGTH!



Components

Form Tie Face

Tie face for attachment of finishes can be exposed or recessed



Components

Reinforced Concrete Core

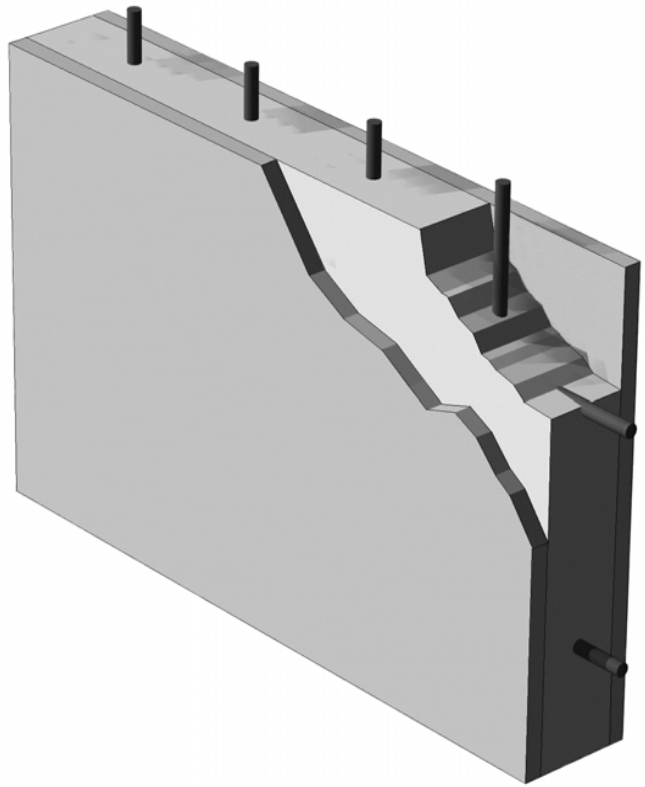
4″, 6″, 8″or 10″ thick Monolithic,

2,500 to 4,000 psi

6″slump

3/8″ aggregate

Rebar = 40 or 60 ksi



End Result

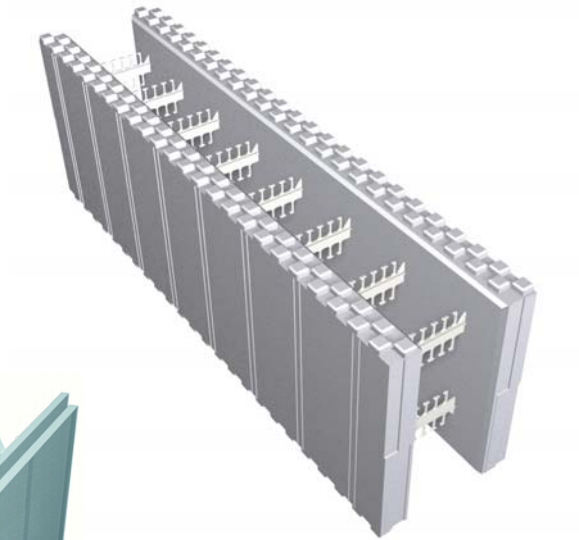
Exterior shell with:

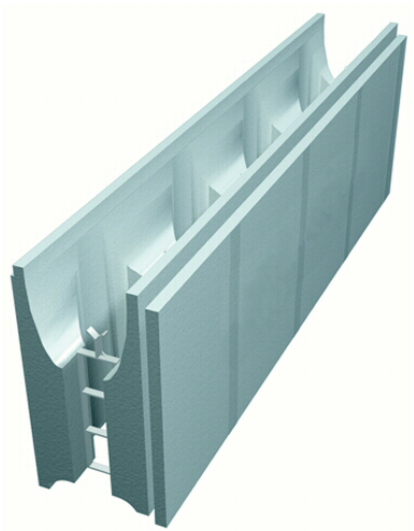
- Superior strength
- Thermal performance
  - High R-value
  - Thermal mass
  - Virtually no thru wall infiltration
- Acoustical attenuation
- Disaster resistance
- Low Maintenance

Variations on a Theme

70+ ICF Manufacturers

- Assembly Method affects contractor.
- Cavity Configuration affects structural designer.





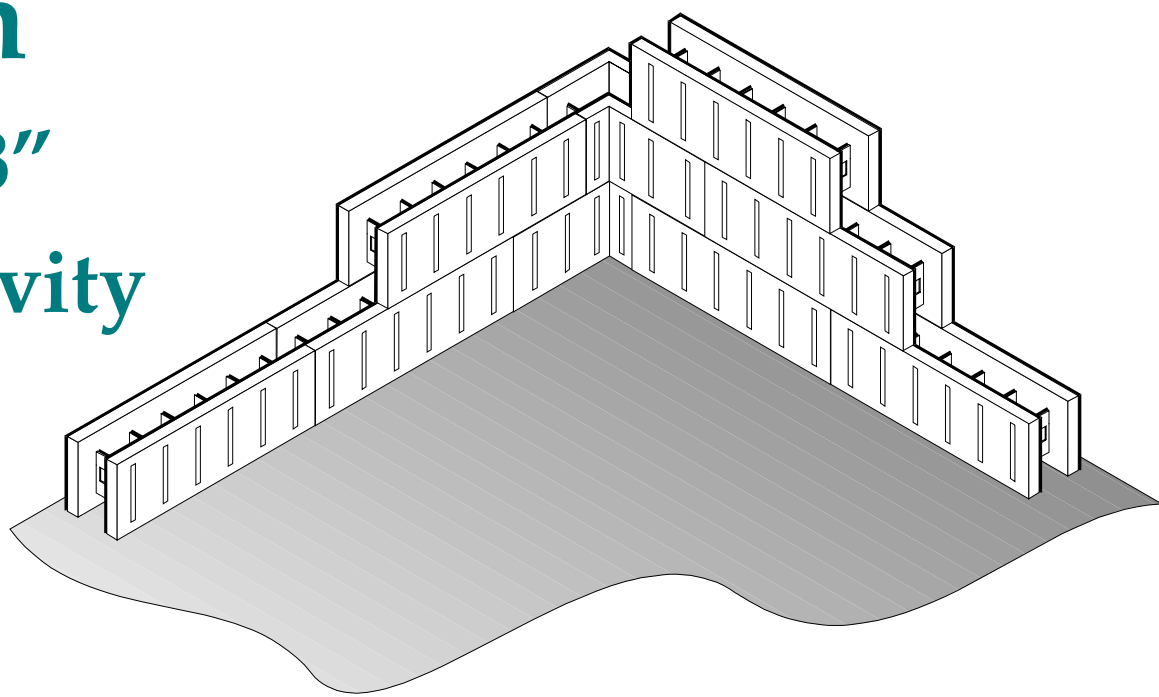
Assembly Methods

Block system

Typically 16″ x 48″

4″, 6″, 8″or 10″ cavity

Assembled or kd



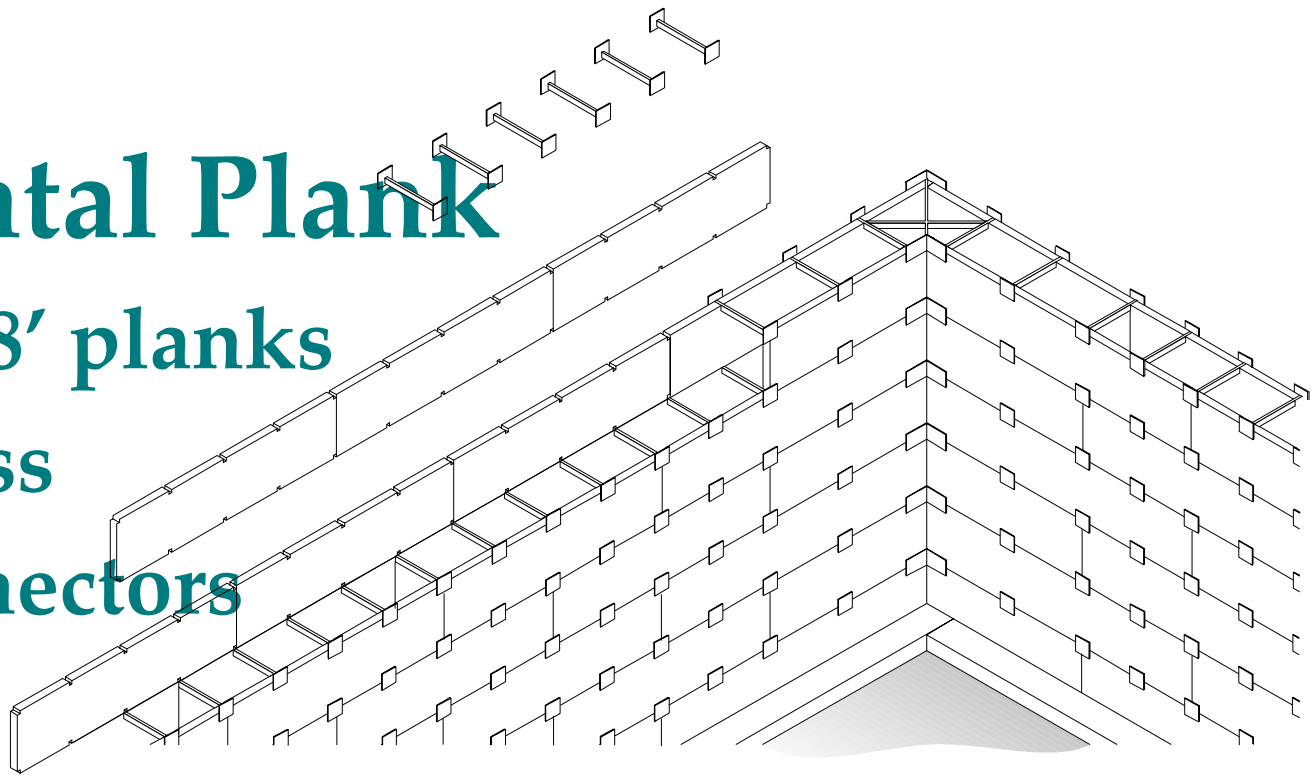
Assembly Methods

Horizontal Plank

12″ x 4′ or 8′ planks

2″ thickness

Loose connectors



Assembly Methods

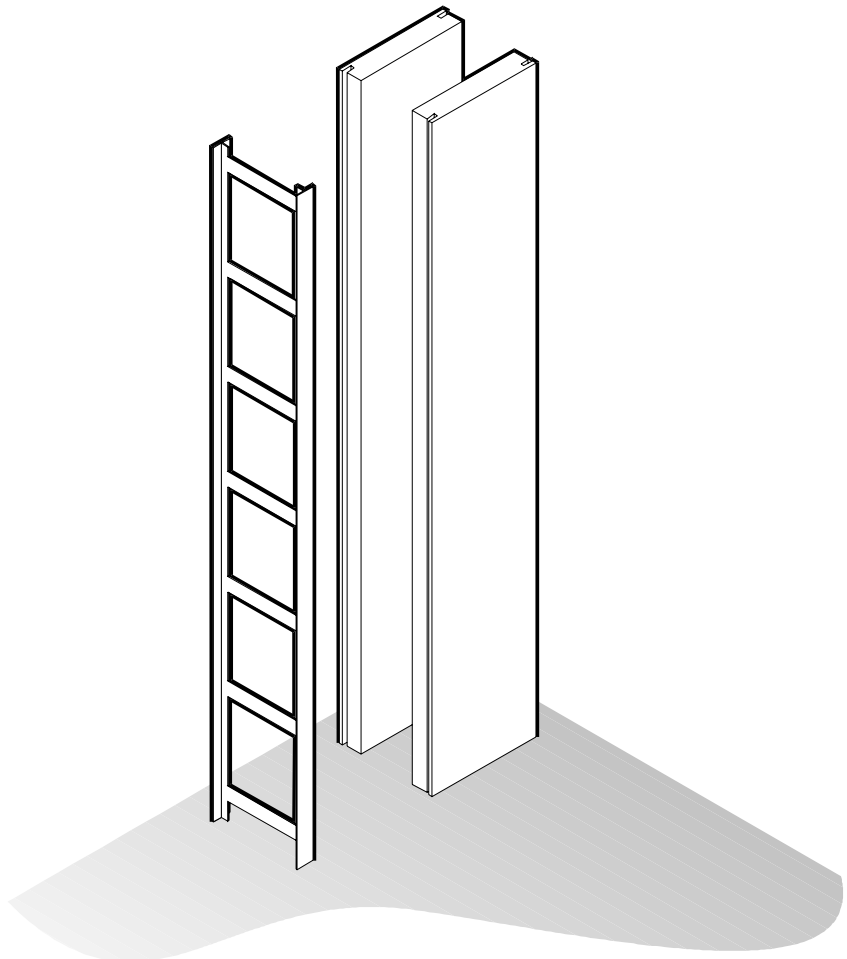
Vertical Plank

Metal or plastic "rail", similar to shaft-wall

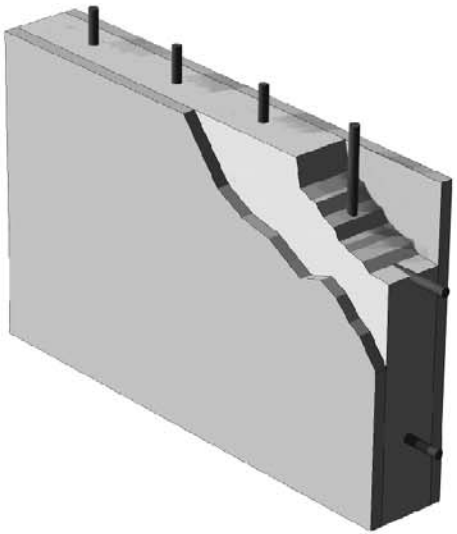
12″ x Height required

2″ thick planks

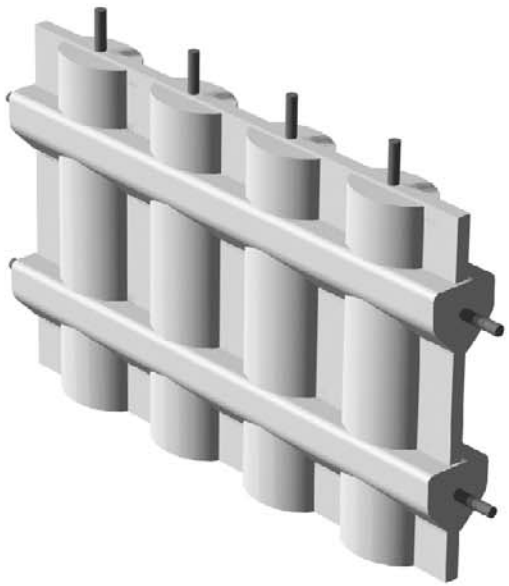
Unassembled



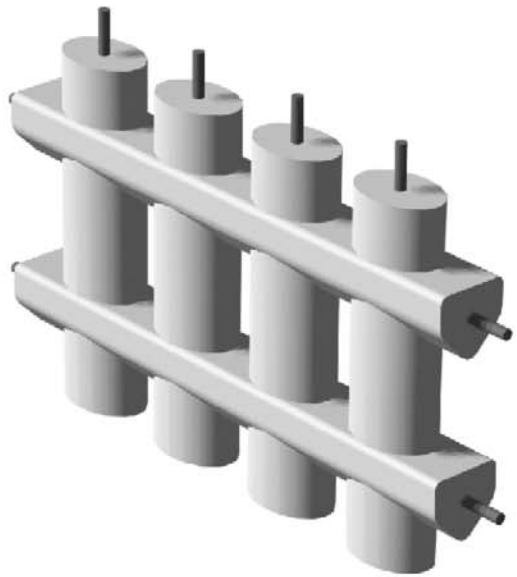
Cavity Configuration Design Factor



Flat wall core with foam in place



Waffle grid core with foam removed for clarity



Screen grid core with foam removed for clarity

Courtesy of the Portland Cement Assocation, 2001

Fabrication

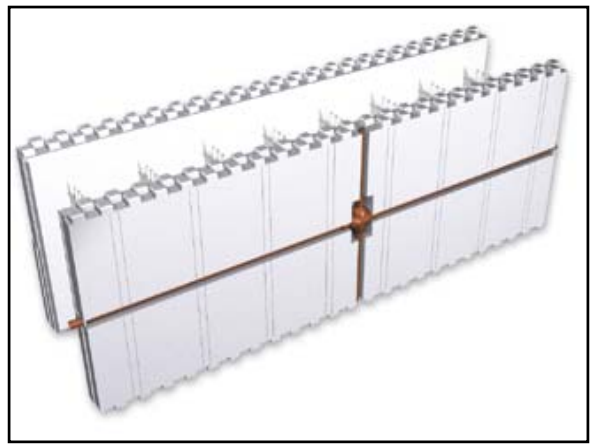
Lightweight

Common
Hand-tools

Versatile

Allied Trades

Masonry/Stucco



Electrical

Drywall

Benefits of ICF's

Disaster Resistance

Acoustical Attenuation

Maintenance and Durability

Thermal Performance

Sustainability

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Energy and Atmosphere

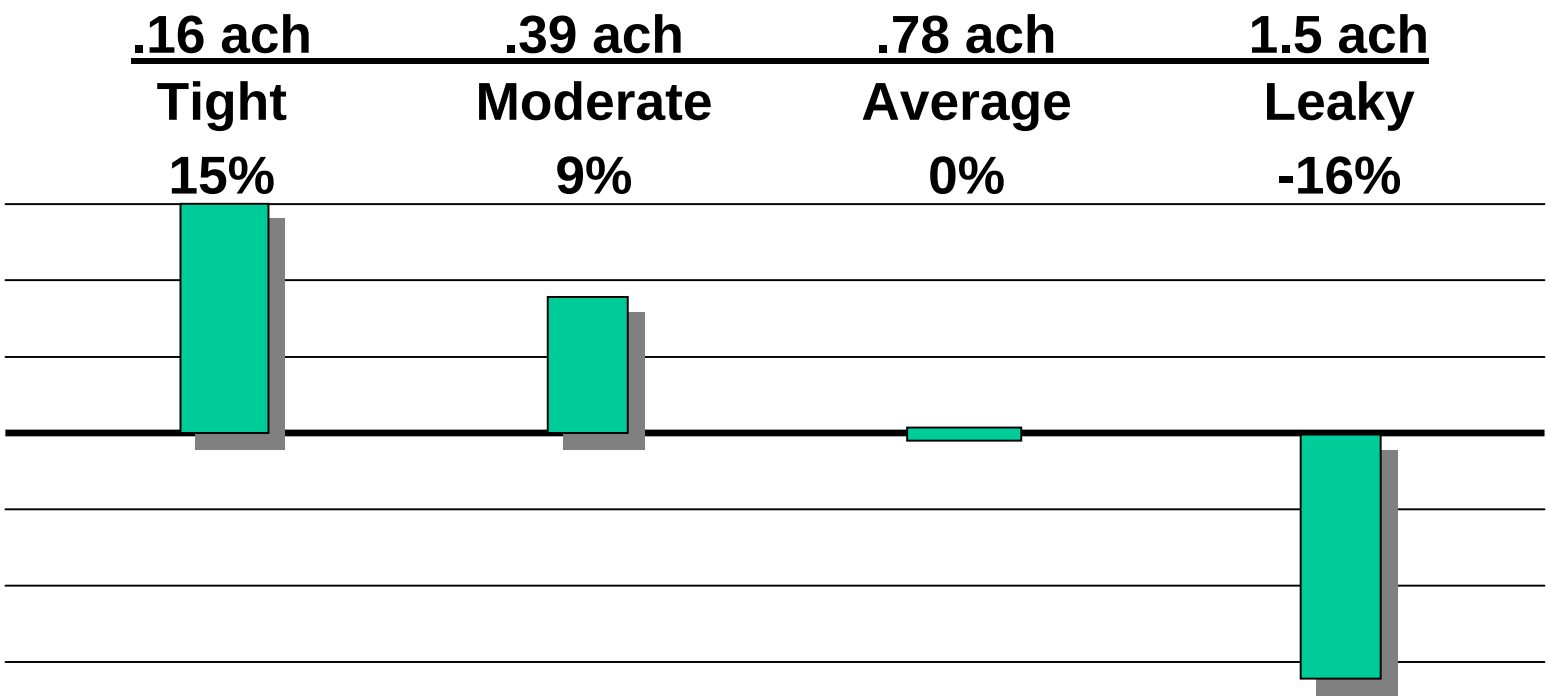
- Prerequisite 2: Minimum Energy Performance

- Credit 1: Optimized Energy Performance

Building the exterior walls with Insulating Concrete Forms contributes to this requirement and credit by providing superior air tightness, insulating value, and thermal massing.

Air Infiltration

Energy Savings related to Air Changes / Hour



Thermal Performance

High R- values	R-18 to R-22
Thermal mass benefits	varies by climate
Low infiltration	virtually none through the wall

Thermal Mass

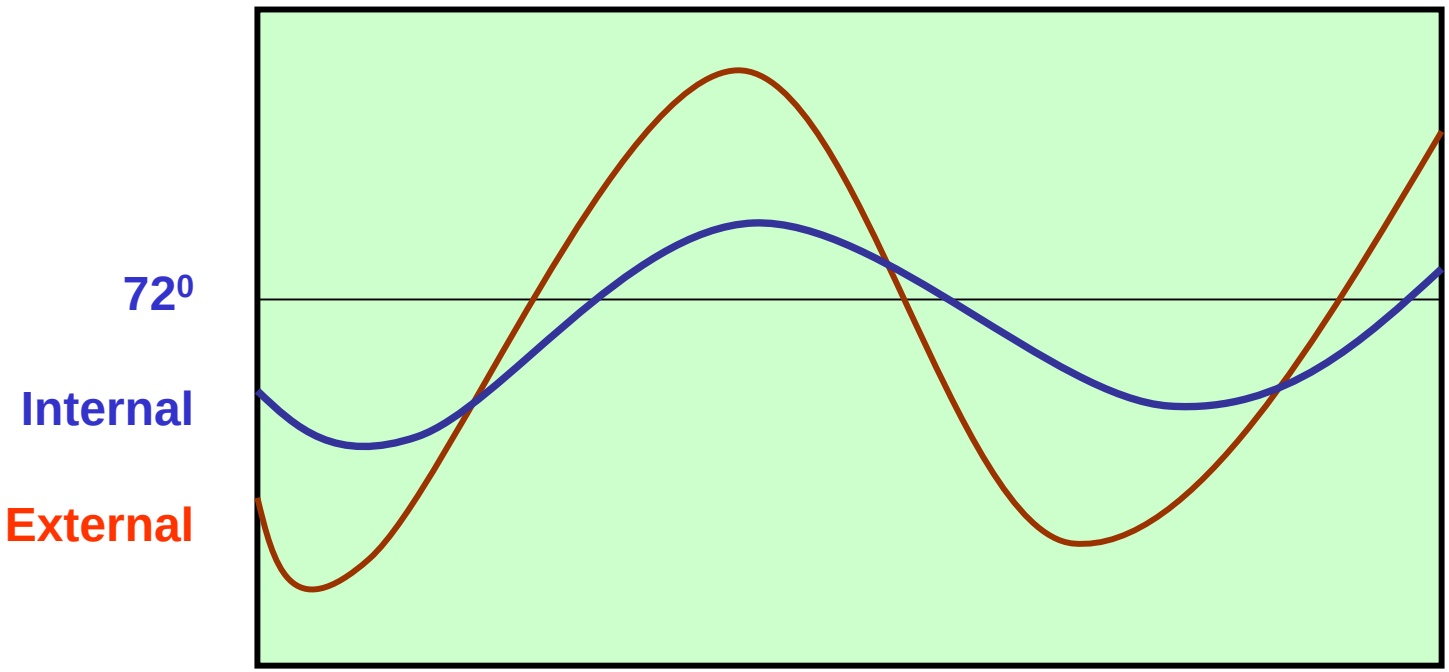
Thermal mass principles have been used for centuries.

Thermal Mass

Moderates internal temperature swings.

Increases occupant comfort.

Reduces energy requirements.



R-Value, Mass and Infiltration Combined

Wall type	Therms	kWh	Cost*, U.S. dollars	
			Equal ACH**	Typical ACH***
2x12 (R-38) frame	1368	2770	1302	1419
Flat-Panel ICF	1388	2675	1310	1258
2x10 (R-30) frame	1400	2828	1332	1452
2x8 (R-25) frame	1432	2886	1362	1485
Typical sandwich panel	1494	2592	1387	1332
Waffle-grid ICF	1493	2805	1404	1348
Engineered sandwich	1513	2671	1408	1352
2x6 (R-19) frame	1486	2983	1413	1540
CMU	1508	2887	1422	1365
Exterior insulation	1568	2751	1458	1400
Interior insulation	1567	2984	1476	1417
Steel frame	1564	3107	1484	1647
2x4 (R-11) frame	1623	3232	1541	1680

* Based on average U.S. energy rates described above.
** Air infiltration rate of 0.35 ACH. Ranking is performed on this column.
*** Air infiltration rate of 0.15 ACH for the mass walls, and 0.78 for the frame walls. Cost adjustment based on Table 14.

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Material and Resources

- Credit 2: Construction Waste Management
- Credit 4: Recycled Content
- Credit 5: Regional Materials

Incorporating ICFs can help a project qualify for points by reducing waste, increasing recycled content, and by increasing the use of locally derived materials.

Construction Waste

Reversible Flat Wall ICF systems reduce waste on site.

Components can be cut and fit, remaining pieces used elsewhere.

If there is waste, it is 100% recyclable.

Recycled Materials

Use ICF systems containing recycled content:

- Post Consumer
- Post Industrial

Regional Materials

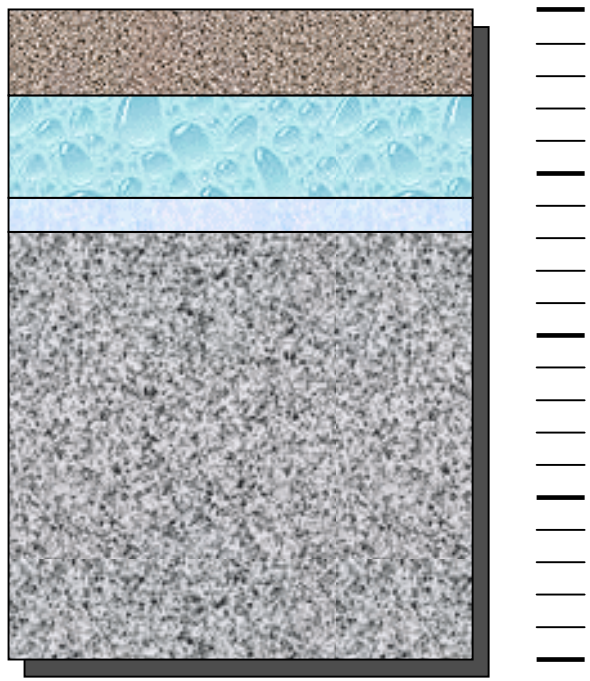
Locally derived

Cement

Water

Air

Coarse and Fine Aggregates



Regional Materials

Use ICF systems manufactured within 500 miles of project.

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Indoor Environmental Quality

- Credit 7.1: Thermal Comfort

Tight construction reduces air infiltration

Thermal mass tempers wall surface temperature swings

Dry inert materials prevent accidental humidification and condensation

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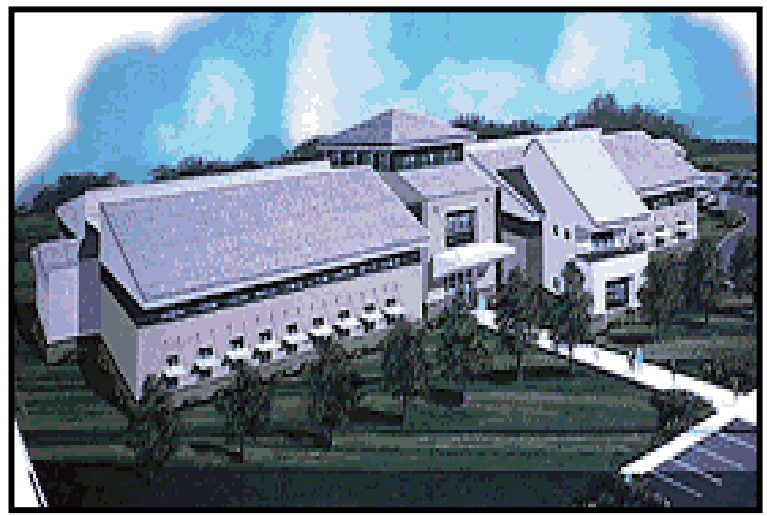
Innovation & Design Process

- Credit 1: Innovation in Design
  - No off gassing
  - Diminishes Petroleum Byproduct Waste
  - Deconstruction
  - Long Life Cycle
  - Mold Growth Control

Building Green with ICFs

LEED ™ Gold Certified Project

- Insulation Levels
- Air tightness
- Benign Materials
- Recycled Materials
- Local Materials
- C&D Waste Management



Pennsylvania DEP Cambria Office Building
36,000 sf, 125 occupants 45 LEED™ Points

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